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ABSTRACT

A study was conducted to determine the effectiveness of the use of computers in Arizona vocational education and to provide a profile of those uses. Data were collected through telephone and on-site interviews of approximately 100 persons involved in vocational education at high schools and community colleges. Although the study concluded that computers have not been used in the state long enough to judge their effectiveness, some successful uses, techniques, and approaches were identified. For example, it was found that the major use of computers was the teaching of programming. Beyond that, the primary vocational applications were to be found in teaching the use of the computer as a tool; the programs in which this use appeared most frequently were business and drafting. The major difference between high school and community college approaches was that the college classes were more often teaching the basic concepts of generic applications, rather than machine- and program-specific skills, the approach used in most high schools. Few instructors used the computer for computer-assisted instruction (CAI) or for classroom management. Some of the major obstacles to more widespread use of CAI were deficiencies in teacher-training, the availability of appropriate software, and the availability of funds to purchase software that is available. The major obstacle to using the computer in classroom management appeared to be the lack of school-wide and/or district-wide computerized management systems with which teachers could interface. Recommendations were made for overcoming these obstacles to encourage more widespread and effective use of computers in Arizona vocational programs. (KC)

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THE EFFECTIVENESS OF COMPUTERS IN VOCATIONAL EDUCATION INSTRUCTION

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FORWARD

The purpose of this study was to examine how computers are being used in Arizona vocational education instruction. The objective was to determine the effectiveness of the use of computers, while providing a profile of the uses. Although it has been determined that computers have not been employed in vocational education instruction in Arizona long enough to judge their effectiveness, the research conducted for this study has made it possible to identify some of the factors that can help to make the use of computers more effective.

The data gathering for this study, which was accomplished through a series of telephone and on-site interviews, was performed by a team of interviewers including: Dr. Barbara Gutheil, Assistant Director for Research; Dr. Sid Borcher, Consultant; A. Hyatt Simpson, Research Assistant; and Graduate Student Assistants Bert Bradley, Laurie Levy, and Robert Sorrels.

The results of this study will provide useful information to users and potential users in education as they expand and/or develop their computer resources. In addition, the findings and recommendations constitute a sound basis for improving the effectiveness of vocational education instruction in Arizona.

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EXECUTIVE SUMMARY

Study Objectives

As with most areas of our everyday life, computers are being used in education more and more. This report concerns the use of microcomputers in the instruction of vocational education in Arizona. In researching the subject, the literature revealed that there are several ways that computers can be effectively used in conjunction with teaching--in theory. However, the actual use is much more limited, for various reasons.

The objective of this research was to determine the effectiveness of the use of computers in Arizona vocational education, and to provide a profile of those uses. The profile included how the computers are being used, and what seems to be some of the keys to effective use. This was accomplished by conducting an informal survey of users of computers in vocational education classes in high schools and community colleges around the state.

Methodology

The first step in the survey was to canvass knowledgeable people in the education field throughout the state to obtain names of instructors in vocational education who were known to be making extensive use of computers in their classes. With the list which resulted, a preliminary survey of over 50 individuals was conducted by telephone, to obtain basic information on types of computer use, the hardware and software being used, and other relevant facts.

Based on the telephone survey information, a group of schools were identified for on-site interviews. The selection was made in order to have at least one high school and one community college in each of the vocational program areas. The instructors identified were thought to be using the computer in their classes at least as much as, or more than their colleagues in other schools. The purpose of the on-site interviews was to obtain more in-depth information about how computers were actually being used in the classrooms, with input provided by teachers and administrators. Approximately 25 teachers and 15 administrators at 5 high schools and 4 community college were interviewed.

Findings

One of the first conclusions derived was that computers have not been used long enough in this state to allow judgements to be made about the effectiveness of their use. Nevertheless, it was possible to identify uses, techniques, and approaches being employed which were more effective than others.

It was found that the major use of computers in general was the teaching of programming. Beyond that, the primary vocational applications were teaching the use of the computer as a tool; the programs in which this use was most commonly encountered were business and drafting. The major difference between high school and community college approaches was that the college classes were more often teaching the basic concepts of generic applications, rather than machine- and program-specific skills, the approach used in most high schools. There were relatively few instructors who were using the computer as a "teaching machine" (computer-assisted instruction, or CAI) or for classroom management.

Some of the major obstacles to more widespread use of CAI were teacher-training, the availability of appropriate educational software, and the availability of funds to purchase software that is available. The major obstacle to using the computer in classroom management appears to be the lack of school-wide and/or district-wide computerized management systems with which teachers can interface.

Recommendations

The recommendations which resulted from this study are presented below:

I. Computer Skills for Jobs

A. A vocational education teacher who wishes to introduce computers into their courses should begin by looking at the occupational area and identifying any applications in which computers are used on the job, and incorporate the teaching of the relevant computer skills into the curriculum.

B. The software needed to demonstrate and teach the skills should be identified from the industrial applications (such as the recordkeeping and other farm management programs used in Agriculture, nutrition software for Home Economics, and CAD software in Drafting).

C. Advisory councils consisting of representatives of business and industry should be used to help determine the appropriate skills to be taught, as well as the type of software and hardware to be used.

D. In vocational education, the teaching of programming should be de-emphasized in favor of computer literacy/awareness and vocational applications which are oriented towards business/industry uses (with the exception of teaching programming as an occupation).

E. In courses where computers are being used, generic applications should be emphasized so that the students are able to transfer their skills to machines other than the ones on which they learned.

II. Computer-Assisted Instruction

A. Other than in the business programs, vocational education teachers should concentrate their limited funds and time on obtaining software. Their first priority should be software to teach the core concepts--those which will not change rapidly, and will not need frequent changes and updating.

B. Other studies have demonstrated the effectiveness of motivating students to learn basic math and English skills when they see the relevance to their occupational goals. For vocational students needing remedial work in the basics, it is recommended that software should be sought which would teach the basics through relevant occupational applications.

C. Given that one of the major limiting factors in the development of computer-based education is the lack of educational software appropriate to many of the vocational areas, it would be helpful if a statewide resource was initiated to both develop educational software for specific vocational areas, and a "bank" of software which teachers could access for CAI and vocational applications.

D. As part of an effort to establish a statewide resource for CAI in vocational education, instructional materials and resources already being used in the state should be examined and considered for statewide dissemination.

E. Before plunging into the full-scale acquisition of hardware for vocational courses, vocational teachers should explore the possibilities of using existing school computer resources, specifically any general purpose labs which allow scheduling on a short-term basis. The rationale behind this recommendation is that at first, most vocational programs will not have the software which would allow full-time use of a lab. Therefore, until teachers are capable of more fully integrating CAI into their courses, it may not be necessary to have computers in their classrooms.

III. Teacher Training

A. For any teacher planning to incorporate Computer-Based Education (CBE) into their classroom, comprehensive in-service training should be available. Moreover, ongoing seminars should be offered for purposes of keeping up to date.

B. If possible, computers should be made available to teachers during the summer, to assist them in developing computer resources for their classes in the fall.

IV. Common Core Computer Competencies for Vocational Education

A. Existing competency lists should be reviewed to determine which competencies require computer skills on the job.

B. The Arizona Center for Vocational Education Core Computer Curriculum can serve as a starting point for identifying and developing job-related computer competencies.

C. In addition, further research is needed to determine what business and industry's needs are in terms of computer skills and, concommitantly, what kinds of hardware and software are being used in relationship to those skills.

D. A centralized "bank" of software should be established to assist in the teaching of job-related competencies.

TABLE OF CONTENTS

	Page
FUNDING	iii
FORWARD	iv
EXECUTIVE SUMMARY	v
Chapter	
1. INTRODUCTION	1
2. EVOLUTION OF COMPUTERS IN EDUCATION	3
Hardware	3
Software	3
3. RELATED LITERATURE	5
Overview: Computer-Based Education	5
Definitions	5
Effectiveness	6
Cost	7
Other Effectiveness Indicators	8
4. RESEARCH METHODOLOGY	11
Instrumentation	11
Procedures	12
Telephone Survey	12
On-Site Interviews	12
Study Limitations	13
5. FINDINGS	15
Overview	15
Differences in Approach: Secondary vs. Post-Secondary	15
Computer-Aided Instruction vs. Instruction in Computers	15
Classroom Management	16
Computer-Assisted Instruction	16
Developing Computer Resources	16
Summary of Applications by Program	17
Agriculture	18
Business and Office	18
Health	20
Home Economics	20
Trade & Industry/Industrial Arts	21
6. CONCLUSIONS	23
Increasing the Effectiveness of the Resource	23
Increasing the Effectiveness in the Classroom	23

TABLE OF CONTENTS (Continued)

	Page
7. RECOMMENDATIONS	25
Computer Skills for Jobs	25
Computer-Assisted Instruction	25
Teacher Training	26
Common Core Computer Competencies for Vocational Education	26
REFERENCES	29

Appendix

A. TELEPHONE INTERVIEW	31
B. TELEPHONE INTERVIEW RESULTS	35
C. ON-SITE INTERVIEWEES	43

CHAPTER 1

INTRODUCTION

The original goal of this project was to determine the cost-effectiveness of computer-assisted vocational education instruction. This was to include a survey of all public secondary and post-secondary educational institutions in Arizona. However, after consultation with the Arizona Department of Education (ADE) staff and a review of the current literature, it was determined that a cost analysis would be premature. The current literature indicated that, given the state-of-the-art of cost analyses in education, such an undertaking would be beyond the scope of this project. The ADE staff also revealed that this type of information would not be relevant to the vocational education community at this time, as computer-assisted instruction is still in the developmental stage and not yet refined.

The revised goal of the project was to develop a profile of the use of computers in vocational education in Arizona, and insights into what makes those uses effective--as well as what could make them more effective. In addition, the advisory group of ADE staff and industry representatives agreed that a statewide survey of educators would not be practical, in light of the probable extent of use of computers. Rather, based on the knowledge gained from other studies on computer use in business and office programs and on the development of a core computer curriculum, those using the computers the most extensively in their classrooms would be identified and contacted.

The purpose of this study was not to judge the schools on the effectiveness of their use of computers, but to provide them with an aid to evaluate their own situations. In addition, the study provides useful suggestions and a resource for pursuing further information to those who are upgrading, expanding, or otherwise developing their computer resources.

This report includes a review of the literature on the use of computers in education, a description of the methods of data collection, the findings of the investigation, and the conclusions and recommendations of the study.

CHAPTER 2

THE EVOLUTION OF COMPUTERS IN EDUCATION

The subject of this study is the effectiveness of computer-aided instruction (CAI) in vocational education. The relative newness of computers to this field requires an exploratory approach to the concept of effectiveness. Consequently, a necessary task will be to define some of the concepts involved and apply them to the instruction of vocational education. A review of the major approaches to analyses of cost-effectiveness of CAI will lead to a better understanding of the concepts involved. It should be noted that there is a paucity of literature on cost-effectiveness dealing specifically with vocational education, which adds to the exploratory nature of this study.

Before proceeding, a working definition of instructional computer is needed. The definition used here was deliberately simple, in order to allow flexibility as we explore the environment in which computers are utilized for the classroom. To be considered a computer, the machine must produce more than routine mathematical computations and be capable of the following functions: data input, data processing, primary storage, secondary storage, and output.

Hardware

Computers have been used in educational settings since the 50's. Mammoth mainframes were used with large-scale instructional systems such as the powerful computer-based educational system, PLATO, developed at the University of Illinois and TICCIT, the instructional system developed at Brigham Young University (Hall, 1982). The equipment used was complicated and required specialized personnel for operation and maintenance and, therefore, was not generally accessible to other than post-secondary educational institutions.

As the technology of integrated circuitry progressed, computer size and power were concentrated into smaller physical units. The evolution was from mainframes or maxisystems, through minisystems, to microcomputers. With the rapid expansion of the microcomputer market, schools at all levels, including elementary schools, have access to affordable hardware. The first computer used for instruction in a school cost a third of a million dollars; today, microcomputers with good graphics cost under one thousand dollars.

Software

The publishing and distributing of courseware, or software for educational purposes, is "prerequisite for CBE (computer-based education) to be widely used for education" (Hall, 1982). The development of software requires specialized knowledge and a great deal of time and energy--some

very definite barriers to the classroom teacher who would like to integrate the computer into the classroom. Nevertheless, even with the apparent demand, educational publishers are not jumping on the bandwagon. The software which is being produced is concentrated in the drill-and-practice mode, with very little in the production of "intelligent" tutorial programs (Report on Education Research, 1984).

Software appropriate to the educational setting is presently a major limiting factor in the widespread use of computer-based education, especially in vocational education. Because of this, some experts are predicting that the computer may never amount to more than an electronic page-turner in the classroom (Report on Educational Research, 1984).

CHAPTER 3

RELATED LITERATURE

Overview: Computer-Based Education

Definitions

Computer-aided instruction (CAI) is defined by Newman (1982, p. 7) as "a teaching process directly involving the computer in the presentation of instruction materials in an interactive mode to provide and control the individualized learning environment for each student." He points out that CAI has mainly included drill-and-practice, remedial, and tutorial activities such as problem-solving, simulation of scientific and social problems, and gaming. This is essentially an all-encompassing definition, embracing several elements of what Hall (1982) refers to as "computer-based education" (CBE), of which CAI is but one technique.

In addition to CAI, the applications which Hall includes in CBE are computer-managed instruction (CMI) and computer-based instructional simulation (CBIS). He places these applications on a continuum of increasing complexity, with CMI being the least complex and CBIS being the most complicated. A brief description of each of these applications should give the reader a better idea of the possibilities for uses of the computer in the classroom.

According to Hall, computer-managed instruction involves the use of the computer as a recordkeeping device, and not in the direct instruction of the student. In the more sophisticated applications of CMI, the computer is used in an interactive mode with the student and provides diagnostic-prescriptive strategies based on the student's responses. At this highest level of application, CMI "provides the following instructional functions: (1) assesses the learner's present level of knowledge, (2) diagnoses weaknesses or gaps in the student's learning, (3) prescribes learning activities to remediate the identified weaknesses, and (4) continuously monitors progress of the learner" (Hall, 1982, p. 353).

In Hall's review, computer-assisted instruction refers to the application he describes as "interactive instruction," which includes the instructional strategies of tutorial and drill-and-practice. "Instructional functions of interactive instruction include the following: (1) display content to the learner, (2) provide opportunity for practice on the content, (3) provide feedback to the learner, (4) consolidate learning, and (5) enhance retention" (1982, p. 354).

Computer-based instruction simulation (CBIS) is the most complex and powerful of computer applications in education, according to Hall. He suggests that instruction and evaluation can both be integrated with CBIS. The simulations "establish (1) a model situation that imitates some aspect of reality and (2) a problem that utilizes the model. The model may be either a static situation, in which conditions do not change during the

student's interaction with the model, or a dynamic situation, in which conditions change as a result of the learner's actions and solutions" (Hall, 1982, p. 354).

Computer-based education then involves an array of applications of the computer to classroom activities. The applications range from simple recordkeeping, in which the computer becomes an electronic gradebook, to the more complex simulations, where the computer can be used to instruct the student as well as evaluate the student's progress. For purposes of this study of the effectiveness of the use of computers in the vocational education classroom, any of the above-described applications would be considered computer-assisted instruction, or CAI.

Effectiveness

The concept of cost-effectiveness of CAI has been treated two ways in the literature reviewed here: a quantitative analysis to arrive at a dollar cost and a qualitative analysis of the educational effectiveness. To facilitate the discussion, the qualitative, or educational aspects will be examined separately from the quantitative, or cost aspects.

Effectiveness of CAI has been examined from several different angles. In a review of the research on the subject, Bracey (1982) found the outcomes fell into three areas: achievement, affect/motivation, and social. Achievement outcomes involved scoring on objective tests, retention, and speed of learning. It was found that, compared to traditional instruction, students who received CAI scored better on objective tests, their retention was improved and the speed at which they learned the material was improved.

Affective/motivational outcomes included attitudes about computers and about learning with computers. Bracey noted that the research showed that computer use seems to provide students with positive attitudes towards CAI, due to qualities inherent in the process of learning with computers. The positive aspects include: being able to move at their own pace, a lack of embarrassment about mistakes, and a sense of control.

The social effects observed by Bracey indicated that there was more collaborative, cooperative problem-solving among students involved in programming activities. Similar impacts on the "social organization of learning" have been observed in studies by the Center for Social Organization of Schools (1983) and by White (1983). In the former's "National Survey of School Uses of Microcomputers," they also observed that "above-average" students were learning more than "average" or "below-average" students.

A Canadian study of computer-based instructional support (CBIS) (Brown et al, 1980) viewed effectiveness in terms of (1) time-savings for teachers and (2) coordination of implementation. It was generally found that (cost) effectiveness was related to coordination of implementation with other users. One of the suggestions in the study was that to be effective, implementation of CBIS must be part of an overall plan for computerization

for the state. In addition, the report stated that "an effective CBIS will be achieved only if it is perceived by teachers to be of value and is easier to apply than whatever methods they may now be using" (p. 6).

An assessment of CAI in Pennsylvania (Hall, 1970) indicated that it is difficult to compare CAI with conventional instructional methods because of the differences in objectives and evaluation techniques. However, it was noted that "investigations have consistently shown that the same amount of material has been learned in a CAI environment as in conventional classroom although with a considerable savings of time in favor of CAI" (Hall, 1970, p. 13).

In sum, effectiveness of CAI has been related to several major aspects of classroom outcomes. These include the student outcomes of achievement, affect/motivation, social, and the social organization of learning. In addition, CAI effectiveness has been evaluated on the basis of savings of time for teachers. Finally, it has been noted that the effectiveness of CAI is affected by planning and coordination of implementation.

Cost

The treatment of cost as a determinant of cost-effectiveness of CAI has been perfunctory at best in the literature of the past five years. This appears to be due to the difficulty of costing a technology that is so new to educational use and constantly changing in its applications. Charp and Sebastian (1978) found that with the advent of computer-managed instruction (CMI), it is no longer meaningful just to compare CAI costs with teacher instructional costs, as was done successfully until the early 70's. In earlier analyses, CAI was largely used in a tutorial mode and thus did much the same thing a teacher did. This allowed a meaningful comparison of teacher labor per hour with CAI. With CMI added into the equation, we are no longer looking only at a direct substitution of technology for labor, but rather an augmentation of labor by technology (Charp and Sebastian, 1978).

The conventional approach to costing CAI is to divide the entire system costs by the total number of students of student contact-hours. This is the approach used by Grady (1983), where the cost-effectiveness of integrating computers into the curriculum were said to be "clear" when per-pupil costs were amortized over a three- to five-year period.

Lyons Township (Levin, 1982), probably one of the most aggressive users of computers found in the literature, used the per-pupil cost analysis and found that it came to about $7.50 per year over a five-year period.

The total system costs used in the conventional approach includes such factors as hardware and software costs, supplies, personnel, curriculum development, and system maintenance. These costs are also considered in Charp and Sebastian's approach; however, their analysis was based on the use of a large-scale mainframe-based system and the use of a combination of CAI/CMI. Since the combination approach will undoubtedly enter into the

analysis for many schools, some of the additional elements of their analysis should be considered in developing an understanding of cost-effectiveness of CAI.

The total cost of the use of the system for vocational education can be looked at as a proportion of the total system cost, and then divided by the total number of students using a computer for vocational education purposes. However, if the use of the computers is expanded beyond tutorial and drill-and-practice, then the nature of student contact hours may have to be adjusted to reflect the ratio of instructional activity not directly utilizing a computer, to on-line activity, in order to estimate actual time on task. The determination of instructional hours would need a similar treatment if CAI is expanded. The on-line to off-line instructional activity would also have to be taken into account.

Other Effectiveness Indicators

Charp and Sebastian (1978) also refer to several hidden benefits which result from the use of CAI/CMI. Among the benefits are: the distribution of costs through sharing of systems; the time-savings to the student; greater flexibility of scheduling; and--with the savings of time--the opportunity to offer additional courses, the possibility of accelerated graduation, and fuller use of facilities.

One of the focuses of the National Survey of School Uses of Microcomputers (The Johns Hopkins University, 1983b) was on how much the micros are actually used. Since one of the elements of a cost analysis has to do with the number of contact hours, it is interesting to note the issues examined in this national study. It should be kept in mind that the survey was based on a school-wide usage of computers.

The typical school (the median case) in the National Survey (1983b) has about 5 microcomputers, each in use for 13 hours per week. Only one or two teachers are regular users in 50 percent of the secondary schools. "Regular users" included teachers who either use packaged programs or who teach programming. In the other 50 percent of the schools, more than two teachers are regular users--the majority using packaged drill-and-game programs. Seventy percent of schools possessing micros have at least one teacher who uses the computer more extensively than for packaged programs and teaching of programming. Student use was described as follows:

> About 80 students (in a student body of 700) use the equipment in an average week--a little more than 45 minutes per user. Programming and computer literacy activities occupy fully two-thirds of the instructional time on computers..."Drill-and-practice"activities take up another 18% and the remainder is split among "learning games," various advanced applications such as word processing, science lab work, and business courses, and other activities (The Johns Hopkins University, 1983b, pp. 6-8).

One other way of examining the costs of CAI was noted in the study of instructional computing in Arizona (Newman, 1982): the proportion of the total instructional budget expended for computer use. It was found that schools in Arizona are spending about $.20 on computer use for each $100.00 of total expenditure, including teachers' salaries, or about 3.5% of the total budget for instructional materials. It was also pointed out that costs can be greatly reduced when teachers and students can design or develop their own programs.

To summarize, it appears that no one method of quantifying the cost-effectiveness of CAI is acceptable to all. There are a host of variables which enter into such an analysis, and their application is dependent on the situation of the particular school. Consequently, qualitative analyses dominate the literature on cost-effectiveness of computers in education. The bottom line that necessitates such an approach is that "cost-effectiveness must be related to the computer's application in the school rather than the actual cost of the equipment. Utilization of a specific technique might be effective for one school, but not for another" (Newman, 1982, p. 28).

The key factor concerning effectiveness, whether in terms of instruction or costs, may be that in today's world, it is critical that students be aware of and literate in the use of computers. According to Bracey (1982, p. 54), "the growing demand for people with technical training in information technology is well documented...regardless of how well computers can assist the teaching of history or composition, their value as vocational tools may make them worth whatever they cost in terms of time and expense."

CHAPTER 4

RESEARCH METHODOLOGY

The data and information-gathering took place in three phases. In Phase one, background information was developed. The relevant literature was reviewed, which included a literature search on the subject of computer-assisted instruction. In addition, guidance was sought from a committee of vocational program staff at the Arizona Department of Education and interested representatives from the business community. As a result of their suggestions, the scope of the project was revised (as described in the introductory section) and a research methodology was formulated.

It was determined that the scope of the project did not permit a statewide survey of computer users in each vocational program area at the high schools and community colleges. The suggested methodology was to identify and interview at least one major computer user in each vocational program area at both the high school and post-secondary levels. In order to accomplish that, a second phase was indicated with a telephone survey to gather preliminary information, followed by a third phase, in which an on-site interview would be used to gather in-depth information.

Instrumentation

A telephone interview was designed to obtain basic information on the hardware and software being used in the various vocational programs, as well as the number of students using computers in those classes and the amount and type of uses. In addition, the interview was used to generate additional names of users to be contacted. A sample of the telephone interview format is presented in Appendix A.

On-site interview instruments were designed for vocational education teachers, administrators, and students. The teacher interview covered three areas: classroom management, instruction, and effectiveness. Information was sought about how the teacher integrated computers into classroom management and instruction, and about the types of hardware, software, and applications they used or were planning to use. In addition, an attempt was made to quantify the use of the computers: how many hours a week the teacher spent using the computer; how many students in each class and the average number of hours per week they spent using the computer; and what percentage of the semester was devoted to the computer in the class. The interview instrument was also designed to obtain the teachers' impressions about the kinds of skills students were learning in each application of the computer, the effects they may have observed on students' learning and attitudes, and any benefits or problems they had encountered in the use of computers.

Another interview instrument was created for those administrators who were identified by the instructors as being familiar with that instructor's

work with computers. However, questions were included which pertained to the entire school or department. Among the questions contained in the administrator survey were some about the computer hardware available to the school in general, and to vocational education classes in specific, and on the physical organization of the computers (in laboratories, individual classrooms, etc.).

The administrator interview also contained questions about the planning process that had occurred in the school's development of their computer resources, and about their plans for expansion or modification. Questions were also included about the impact of computers on teachers and students, and about the possible advantages and disadvantages of computers in the schools. In addition, information was sought on the cost of computer-related resources to the vocational programs, including software, hardware, operation, training, and maintenance.

Finally, an instrument was designed to obtain some feedback from students as to the extent of their use of computers in the class, how they felt about using and learning with computers, and the types of skills they thought they learned by using computers in that class. It was intended that students be interviewed in a group.

Procedures

Telephone Survey

The telephone survey was initiated by first developing a list of users through a wide-ranging canvassing of knowledgeable people in the education field. They were asked for names of educators who they thought were making considerable use of the computer in connection with teaching. No references were obtained of computer-using teachers in the field of health at the high school level or of home economics at the community college level.

Over 50 people were contacted and interviewed by telephone, and they provided basic information on their use of the computer in the classroom and on their school's computer resources in vocational education. From that information, a matrix was created which arranged the data from each interview on several computer-use indicators. The matrix was used to identify teachers and/or schools for on-site interviews. The selection was made on the basis that those identified were doing at least as much or more than their colleagues in other schools. A minimum of one individual was identified for each vocational program area at both the high school and post-secondary levels. The matrix of telephone interview results is presented in Appendix B.

On-Site Interviews

On-site interviews were conducted with 25 teachers and 15 administrators at 5 high schools and 4 community college campuses around the state. Two or three interviewers were present at each interview. In some cases, more teachers were interviewed than originally planned, so as to

investigate informational leads uncovered in previous interviews or to get a better idea of the school's overall vocational education computer use. A list of the schools visited and the teachers and administrators interviewed is provided in Appendix C. Some students were also interviewed or classes observed but, as the on-site strategy was implemented, it was found that student interviews were not very productive.

The interviews took between 30-45 minutes with teachers and about 30 minutes with administrators. Often an interview included a tour of the computer facilities, and occasionally other staff members were called in to participate in the interviews. Some of the planned interviews were cancelled by the interviewees because of conflicting activities, and some could not be scheduled. Therefore, one high school and two community colleges which had been selected were not visited.

Early on, it was found that even the semi-structured interview guides were too structured. Consequently, the interviews became rather unstructured, albeit generally informative. Even though the teachers who were interviewed were selected because they were thought to be using computers the most extensively, there was a wide range of extent of knowledge about computers and of sophistication of applications. Because of that range, the interviewing process differed between interviewees.

Study Limitations

The design of this research was not grounded in scientific theory, nor was it the intent to produce a replicable, statistically significant study. The method used to investigate the subject of computer-based education in Arizona was of necessity a descriptive study--with the objective to describe the existing situation but not its causes. As mentioned earlier, the scope of the project dictated a modified survey of vocational education computer users, rather than one which would reach every such user. It is therefore possible that the approach taken to locate the "extensive" users might have failed to identify all of those individuals. Nevertheless, the results indicate that a reasonably good cross-section was obtained of vocational educators who use computers in the classroom relatively extensively.

The interview guides were another limitation in data gathering. During the course of the interviews, it was found that the subject did not lend itself to even semi-structured interviews. As a result, more information than was planned was obtained in some interviews and in others less was obtained. Therefore, there were inconsistencies in the type of information which was collected from one interview to another. This illustrates the fact that the use of computers in vocational education is still so new that it is difficult to evaluate the effectiveness of computer-based education, let alone obtain a comprehensive picture of the uses.

Finally, it should be noted that, as with so many studies in education, the timing of the investigation is critical. In this case, it was apparently too close to the end of the school year, and consequently,

the scheduling of the necessary interviews was a problem with some schools. It would have been better to have begun the interview process earlier in the semester, perhaps February rather than April.

CHAPTER 5

FINDINGS

Overview

The extent of use of computers in the vocational classes visited ranged from one computer to which students were briefly introduced, to several computer laboratories available to vocational and nonvocational classes alike. There were no consistencies in patterns of use from one school district to another and, indeed, between schools in the same district. However, there were some trends which are described below.

Differences in Approach: Secondary vs. Post-Secondary

First, the main difference which was apparent between the approach to computer-based education in the community colleges in contrast to high schools was that the community colleges were more likely to be teaching the basic concepts of the applications. For instance, in a wordprocessing class at Phoenix Community College, students are exposed to several different wordprocessors so they can become familiar with more than one system. In addition, there were manuals created by the instructor for generic wordprocessing applications.

High school classes, on the other hand, were more often teaching the skills specific to a particular software package, rather than the generic skills. In most high schools the students learn wordprocessing on only one system and, if there is any documentation available, it is from the accompanying manual--which is usually very cumbersome to use. The same is true for other applications.

Computer-Aided Instruction vs. Instruction in Computers

In both high schools and community colleges, the major emphasis with computers is on the teaching of programming. Beyond that, the most frequently encountered vocational education applications were in business and office programs, with wordprocessing and accounting applications, and trades and industry, where computer-aided drafting (CAD) is becoming increasingly popular. The result is that most vocational classes were incorporating the computer as a tool to be learned for specific jobs, rather than as a "teaching machine."

A few school administrators did indicate that there is too much emphasis on programming and that they were hoping to reverse that trend by introducing courses in computer literacy. They felt that literacy courses should provide the students with a basic understanding of computers and their applications, and that computers should be used to teach employment-related applications other than programming.

Classroom Management

There were some isolated cases, such as in some of the biology courses for the practical nursing program at Pima College (downtown campus), where the instructor was using computers extensively for classroom management. In addition, at Phoenix Community College the TICCIT system is being used extensively for testing in many of the vocational programs. Amphitheater High School is introducing a management system called "SASI" (Schools Administrative Student Information), which is a series of programs for microcomputers which can be used for student scheduling, grade reporting, course history, period attendance, and competency testing.

For the most part, teachers were not found to be using computers for management, even at the community college level. A few were aware of some software for the purposes, such as Deer Valley High School where the use of Apple Grade Book is being encouraged. However, since CMI usually was not integrated into the overall school management system, using it in an individual classroom tended to be a duplication of effort.

Computer-Assisted Instruction

Several instances were observed where teachers were employing computers for interactive instruction--mainly drill-and-practice, and to a more limited extent, tutorial. However, it was found that a major limiting factor to this type of use is the apparent lack of appropriate software and/or funds for purchasing the software that is available.

The majority of the teachers who have incorporated computers into their classrooms are "self-taught," having spent their own time to learn about computers. Even with authoring systems such as "E.A.S.E.," developed at Pima College, most teachers have not had enough time to develop their own software. (One helpful approach encountered was to allow teachers to check out a school's computer for the summer to assist in the teacher's effort to learn about computers and their applications in the classroom.) Many teachers noted that their students are often more computer-literate and more proficient with the computer than they are. Due to these limitations, while much of the instruction is individualized in classes where use of the computer is being taught, it often takes place between students.

Developing Computer Resources

The development of computer resources has predominantly been unplanned. Rather, upon the availability of funds, hardware has been purchased without a thorough understanding of the school's needs and of the software availability for the particular hardware. Many districts now have committees which help coordinate the purchase of hardware and software, which should improve the situation. For instance, Sahuaro High School in Tucson created a school-wide committee with representatives from all interested departments. Chandler and Deer Valley High Schools have computer advisory committees made up representatives of computer business

and industry. These committee have been very effective in helping to determine how best to utilize funds in purchasing software and hardware, and in organizing the resources. An example of a top-down, unified approach to comprehensive planning of computer resources school-wide was found at Central Arizona College. However, a trend in the schools, as well as in many other institutions, is still towards purchasing computer resources on the basis of expediency rather than under an overall planned approach.

The planning of computer resources for a school includes the physical organization of the machines. In the high schools where computers were used the most extensively, computer laboratories were set up for several different classes to use. However, it was frequently the case that these laboratories were not always in use for various reasons: the lack of a scheduling mechanism; the lack of expertise on the part of teachers; the lack of software. The community college laboratories did not suffer as much from such problems, and were usually in use for as long as they were open (between 12-18 hours a day).

Another aspect of computer resource development is inservice training. It was widely recognized by those interviewed that teachers and other school personnel are in need of training on the use of and applications for computers, as well as the evaluation of courseware. However, as mentioned earlier, most teachers are self-taught. A few schools contacted do have access to inservice programs (such as in the Tucson Unified District and the Maricopa County Community College District--which has an exemplary inservice program), but the majority of school districts (including community colleges) have not provided a comprehensive program of training to assure that their teachers are fully literate in computer-based education.

A computer resource which was not often mentioned, but which can be a significant one, is computerized information networks. These networks can provide up-to-date information on a wide range of subjects. An example is AGSTAR, which Chandler High School will be subscribing to, for information such as commodity market news and prices.

Summary of Applications by Program

The following section contains a description of the computer resources utilized by the various schools which were visited for on-site interviews, according to vocational program. This section is limited to the school programs which can serve as models in computer resource development. Consequently not all of the programs visited are described here. Those who are interested in following up on the information provided may contact the people listed.

Agriculture

Central Arizona College: This unique class in farm management is taught both in the classroom and in the field, so to speak. The field work takes place at the offices of the farmers who are participating in the three-year program. The hardware used consists of six Compaqs which are used in the field and four Apples for use in the classroom portion. The primary software is the Red River Farm Management Program; also used are Lotus 1-2-3, VisiCalc, and PFS. After the initial semester of introduction, the remaining four semesters of classwork are done on the farm. The computers are rotated with a reference guide from farm to farm. An interesting phenomenon is that even in a class that operates mostly outside of the classroom and spread out over a sizeable geographic area, local user networks develop among the students.
Contact: Pat Harrington, Instructor; Bob Putz, Computer Coordinator.

Chandler High School: In the agriculture classroom there is a TRS-80 Model III which is used for independent work. Otherwise, the students have access to the Home Economics lab to work on 16 tutorials which are part of "AG ED" software published by the University of Illinois. Included in the classes are sections on computer literacy, spreadsheets, and livestock management. The instructor also uses a TRS-80 Model IV in the office rather extensively for such things as grades, reports, FFA membership roster, data from manpower surveys, and letters to legislators.
Contact: Willard Barney, Instructor; Harold Dusick, Assistant Principal.

Deer Valley High School: The computer resources at the school are still so new that there had been very little use of computers by the agriculture students at the time of the visit. A software package called "Hobar Ag Ed Programs" will be used for individualized instruction via drill-and-practice activities. The hardware available consists of an Apple II. Plans are to acquire a farm management program.
Contact: Tim Tankersley, Instructor.

Business and Office

Amphitheater High School: This department has a lab with 16 IBM PC's. Two classes on computer fundamentals are taught in the lab, as is COE, where the computer is taught as part of office procedures and wordprocessing classes through the clerical block. Some of the software used includes Easywriter and a home budgeting program; next year they plan to incorporate spreadsheets and database to replace the use of calculators.
Contact: Beverly Thompson, Instructor; Dr. Robert Carlson, Assistant Principal.

Central Arizona College: This department offers 12 different courses in office services on an open-entry/open-exit basis. Included in the course offerings are medical and legal transcription, accounting, micro business systems, and microcomputer applications. An open lab contains 6 dedicated wordprocessors, 6 TRS-80's, 2 Apple II-E's, and 16 IBM PC's

and/or IBM compatibles. The software which is used includes WordStar, VisiCalc, a database, and an accounting package by TCS.
Contact: D. J. O'Dell, Instructor; Gary Mickolajak, Administrator.

Chandler High School: With a brand new system in place, the TRS Model 16 Xenix which is networked with 15 terminals, the Business Department has been successfully working out a lot of bugs. Presently, they offer two classes in wordprocessing, seven in programming, and two in computer applications in a lab setting. Future plans are to offer automated accounting classes. The wordprocessing software used is Super Scripsit, which is used in the Computer Applications class, along with VisiCalc and MultiPlan. The overall emphasis is to train students for the kinds of applications they will find on the job. Instructors use the computers for grades and tests.
Contact: Jim Meyers, Instructor; Harold Dusick, Assistant Principal.

Phoenix College: The equipment used in the wordprocessing classes (I and II) was selected for use in assisting the teaching of generic applications. There are six each of the MBI 3000 (stand-alone, dedicated) and of the DEC I and II, the latter for a computer approach. Half of each course is taught on one type of machine and half on the other, and there are no more than two students to a machine at a time. In addition, four one-credit special applications modules are offered on an open-entry/open-exit basis in records processing, statistical math, forms, and special projects. There are TRS-80's available for the special projects.

Procedures manuals were developed for the courses--one on each type of wordprocessor for each class. The manuals take the approach of teaching generic applications of wordprocessing, so as to allow transferability of skills.
Contact: Bette Simmons, Instructor.

Sahuaro High School: The students in the two-year Word Information Processing (WIP) class have access to several computer resources: a general use lab with 15 Apple II's, which is used by other classes throughout the school, and a business lab which contains 7 TRS-80 III's, 8 IBM PC's, and 2 IBM Displaywriters, as well as some older wordprocessing machines (a CPT and an IBM 60). The equipment is used 6 periods per day, with up to 35 students per class. A variety of software is used, including Superscript, Easywriter, Alphadatabase, and Scripsit for drill-and-practice activities and some office simulation. A wide variety of skills are taught using the computers, emphasizing the basic office and clerical procedures.

Since 1982 the Business and Office Department has spent approximately $61,833 on hardware, $5,419 on software, $2,400 on supplies, $1,800 on security, and $5,495 on maintenance contracts for the equipment. The latter may be significantly reduced if they are able to institute in-house servicing as planned. Their plans also include upgrading their typing classes to keyboarding classes and incorporating the computer into their model office.
Contact: Barbara Herzog, Department Chair, or Joan Tolle, Instructor; Mr. Johnson, Principal.

Health

Central Arizona College: Noting that eventually every hospital will be using computerized patient-report systems, the Nursing Department has begun to incorporate the use of computers to teach some of its nursing classes. Students in Nursing Practicum I and Nursing II have access to Apples in a computer lab for simulations and tutorials. The software used includes Computer Simulations in Clinical Nursing, Nursing Process, Pediatric Cardiovascular Review, and Medi-Sim. It has been found that most of the nursing software is written for Apple computers and that it is in general very expensive. In addition, the instructor interviewed also uses a computer for classroom management, mainly for preparing syllabi and keeping grades.
Contact: Edna Ross, Instructor; Bob Putz, Computer Coordinator.

Pima College: At the downtown campus, biology courses for the Practical Nursing and Nurse's Assistant programs are thoroughly integrated with computers. The machines are used for drill-and-practice with interactive video. A program called "Aristotle's Apple" is used to write tutorials and generate quizzes. The hardware used is the Apple II, and there are two computers available in a lab, where students in the open-entry/open-exit class can sign up to complete the required number of assignments and tests. The instructor also uses an Apple extensively for classroom management.
Contact: Chris Clifford, Instructor.

Home Economics

Amphitheater High School: Still at the developmental stage of their computer resources, the Home Economics Department has purchased 2 Kaypro's for classroom management and teachers' applications for curriculum. They borrow 2 Apple computers from the school library for student use, which is still quite limited. Using the "E.A.S.E." authoring system, Ms. Graham has written an interactive program about HERO and one on "making change." So far, students have used a program on nutrition from Pillsbury and another from the Dairy Council, "Have A Byte." All are basically drill-and-practice activities. There are plans for purchasing software which will cover several other subjects, such as independent living, restaurant management, and clothing.
Contact: Nancy Graham, Instructor; Dr. Robert Carlson, Assistant Principal.

Chandler High School: With an instructor who is completely self taught in the use of computers in the classroom, students have access to a Home Economics computer lab which contains 8 TRS-80 Model IV's and 1 Tandy 2000. The computers are used for the Nutrition class with some unidentified software, and for HERO, where Super Scripsit is used for doing resumes and for the teenage pregnancy program. In addition, the teachers use an office computer for reports and competencies with PFS and VisiCalc.
Contact: Sue Pew, Instructor; Harold Dusick, Assistant Principal.

Trade & Industry/Industrial Arts

Central Arizona College: The CAD lab, which is still quite new at this school, is equipped with 10 Apple II-E's and digitizers, 1 plotter, 3 printers, 1 TRS-80 IV, and a demonstration monitor. Software used is MATC CAD, second edition. Plans are to incorporate Computer-Aided Manufacturing (CAM) through a CAD/CAM interface, using two TEKMATE systems for the CAM portion. The college has been and will continue sending instructors to training seminars.
Contact: Frank Westerman, Instructor; Gary Mickolajak, Administrator.

Chandler High School: Graphics I and II utilize two dedicated typesetting machines by Compugraphic and a TRS-80 Model IV with Super Scripsit wordprocessing for editing. As soon as funds are available, plans are to get more up-to-date typesetting equipment. Journalism students also participate in learning about this use of computers.
Contact: Bruce Kinde, Instructor; Harold Dusick, Assistant Principal.

Deer Valley High School: The computer resources at this school are quite new--they had been in place only 2 months when this visit took place. The drafting classroom has 4 Teraks, 4 digitizing pads, and 2 plotters. Only the advanced students have access to the computers, on which they will be learning specific CAD skills. The future plans are for an articulation program between the high school and Glendale Community College for a two-hour CAD/CAM class. The instructor is also using a computer in the drafting office for grades and reports.
Contact: Lloyd Meyers, Instructor.

Pima College: At the west campus, Computer-Aided Drafting (CAD) is taught with the philosophy that the computer is a tool to be learned after a minimum of two semesters of traditional drafting. There are two stations available, with one plotter between them. The hardware is Techtronics and the software is K & E. With a plotter, a station costs around $53,000. Operating supplies, etc., cost about $5,000 and the maintenance contracts cost between $10,000-$12,000.
Contact: John Jarchow, Instructor; Ken McCollester, Administrator.

On the downtown campus, CAD is approached with the philosophy that the computer will be replacing traditional methods of drafting, and is offered at the introductory level, without any required prerequisites. CAD is taught as a tool for producing graphics--for blueprint production as well as other types of use. The CAD course serves a support function to other technical courses, such as machine shop. The course is open-entry/open-exit, so it is almost completely self-paced, individualized instruction. Currently there is one station with one plotter, and plans are to add additional stations. The hardware used is an Apple II-E, and the software is CADAPPLE. The equipment and software were donated.
Contact: Marvin Mandel, Instructor; Miguel Palacios, Executive Dean, Downtown Campus.

Phoenix College: The Electronics Department utilizes two computer labs: one for Computer-Assisted Instruction (CAI) and one for computa-

tional problems and programming. The former has 7 Apple II-E's and the latter has 9 TRS-80's. The department also has a PDP-11/40 mainframe on which they are developing a management system. Presently they are using the school's TICCIT system for testing. The CAI lab is used for presenting lessons on basic concepts through tutorials and drill-and-practice. The classes are open-entry/open-exit. The engineering software which is used is from Advanced Microsystems.
Contact: Leroy Stevens, Instructor; Jim Black, Administrator, TICCIT.

The Electronics Department also teaches courses in Biomedical Clinical Technology, in which they incorporate lessons in basic computer awareness. Later in the course, the students work in a hospital as part of the course and learn to use specific computerized medical equipment.
Contact: Peter Zawasky, Instructor; Jim Black, Administrator, TICCIT.

Palo Verde High School: The students in all of the drafting-related courses get some exposure to Computer-Aided Drafting (CAD) on one of two machines available: a Terak system with "T Square" software from T & W and a CADAPPLE system. There is also a CAD tutor for the Apple system. The basic functions are taught with a workbook in which the students are asked to complete certain assignments. The Terak costs approximately $21,000 and the accompanying software $5,000. The cost of the CADApple was about $9,000.
Contact: Robert Mentzer, Instructor.

CHAPTER 6

CONCLUSIONS

The use of computers in vocational education in Arizona is limited but still developing at a rapid pace. Based on the observations from this study, there are several ways to increase the effectiveness of that use. They are described below, not necessarily in order of priority.

Increasing the Effectiveness of the Resource

- Planning is one of the keys to success in developing computer resources. Schools which have been most successful in this have established a committee of school staff who have a stake in the process. One of the missions of the committee should be to research the needs of the various departments and make recommendations about how best to meet those needs.

- Inservice training for teachers and other key school staff is a must. At a minimum, the training should include: literacy, software evaluation, software modification, and instructional design for Computer-Assisted Instruction.

- Hardware should not be purchased until the software needs are established, so that appropriate hardware is selected.

- Advisory committees, made up of business and industry representatives, should be consulted as to the kinds of computer competencies they expect of new employees, the kinds of equipment they are using, and the software that is most prevalent.

- Whenever possible, the computers should be placed in a lab, and the lab should be made available to a variety of courses through flexible, cooperative scheduling.

Increasing Effectiveness in the Classroom

- It appears that one of the most effective applications of the computer in the vocational classroom is to teach it as a tool, the way it will be used on the job. Further, the more effective applications are of a generic nature, rather than specific to a particular program or machine. In other words, a drafting student should be able to go to a job and use a Terak, even if the class was taught on an Apple. The basic skills should be taught, and the students should probably be computer literate enough to transfer their knowledge to various applications on a variety of microcomputers.

* In order to contribute to the students' computer literacy, it is helpful to have available machine manuals which, if necessary, have been modified so that they can be understood and used by the students.

* The potential for use of the computer in instruction of vocational education is unlimited. The uses observed were primarily in the teaching of fundamentals, such as basic concepts, or for providing remedial instruction in the basic skills. The better applications were those which took advantage of the interactive capabilities of the computer, using it as a "teaching machine," as described in the section on Computer-Based Education.

* Incorporating the computer into classroom management can save the teachers immense amounts of time if used correctly. But because most CMI in current use in Arizona is on an individual basis, teachers usually have to manually duplicate their efforts for the school management or the district system. If a school-wide computerized management system were implemented, CMI at the classroom level would be more efficient and effective.

* While many teachers interviewed indicated that the optimal arrangement would be to have a computer station for every student in the class, this is not always economically feasible, or even necessary. Alternate instructional approaches are being used, utilizing teams of two students working very effectively together. The work can also be designed so that half of the class is doing a different type of assignment which does not require the computer while the other half is on the computer. In addition, demonstrations on large monitor screens can effectively replace hands-on experience in some cases.

CHAPTER 7

RECOMMENDATIONS

The goal of this project was to evaluate the effectiveness of the use of computers in vocational education in Arizona. However, one of the major conclusions reached was that computers have not been used long enough in most of the schools to make a valid evaluation of their effectiveness. Nevertheless, given the findings and conclusions which arose from this study, some general recommendations can be made about increasing the effectiveness of computer use in vocational education in Arizona. In addition, recommendations have surfaced concerning support for the development of computer resources statewide. The recommendations are presented below.

I. Computer Skills for Jobs

A. A vocational education teacher who wishes to introduce computers into their courses should begin by looking at the occupational area and identifying any applications in which computers are used on the job, and incorporate the teaching of the relevant computer skills into the curriculum.

B. The software needed to demonstrate and teach the skills should be identified from the industrial applications (such as the recordkeeping and other farm management programs used in Agriculture, nutrition software for Home Economics, and CAD software in Drafting).

C. Advisory councils consisting of representatives of business and industry should be used to help determine the appropriate skills to be taught, as well as the type of software and hardware to be used.

D. In vocational education, the teaching of programming should be de-emphasized in favor of computer literacy/awareness and vocational applications which are oriented towards business/industry uses (with the exception of teaching programming as an occupation).

E. In courses where computers are being used, generic applications should be emphasized so that the students are able to transfer their skills to machines other than the ones on which they learned.

II. Computer-Assisted Instruction

A. Other than in the business programs, vocational education teachers should concentrate their limited funds and time on obtaining software. Their first priority should be software to teach the core concepts--those which will not change rapidly, and will not need frequent changes and updating.

B. Other studies have demonstrated the effectiveness of motivating students to learn basic math and English skills when they see the relevance to their occupational goals. For vocational students needing remedial work in the basics, it is recommended that software should be sought which would teach the basics through relevant occupational applications.

C. Given that one of the major limiting factors in the development of computer-based education is the lack of educational software appropriate to many of the vocational areas, it would be helpful if a statewide resource was initiated to both develop educational software for specific vocational areas, and a "bank" of software which teachers could access for CAI and vocational applications.

D. As part of an effort to establish a statewide resource for CAI in vocational education, instructional materials and resources already being used in the state should be examined and considered for statewide dissemination.

E. Before plunging into the full-scale acquisition of hardware for vocational courses, vocational teachers should explore the possibilities of using existing school computer resources, specifically any general purpose labs which allow scheduling on a short-term basis. The rationale behind this recommendation is that at first, most vocational programs will not have the software which would allow full-time use of a lab. Therefore, until teachers are capable of more fully integrating CAI into their courses, it may not be necessary to have computers in their classrooms.

III. Teacher Training

A. For any teacher planning to incorporate Computer-Based Education (CBE) into their classroom, comprehensive in-service training should be available. Moreover, ongoing seminars should be offered for purposes of keeping up to date.

B. If possible, computers should be made available to teachers during the summer, to assist them in developing computer resources for their classes in the fall.

IV. Common Core Computer Competencies for Vocational Education

A. Existing competency lists should be reviewed to determine which competencies require computer skills on the job.

B. The Arizona Center for Vocational Education Core Computer Curriculum can serve as a starting point for identifying and developing job-related computer competencies.

C. In addition, further research is needed to determine what business and industry's needs are in terms of computer skills and, concommitantly,

what kinds of hardware and software are being used in relationship to those skills.

D. A centralized "bank" of software should be established to assist in the teaching of job-related competencies.

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APPENDIX A

TELEPHONE INTERVIEW

TELEPHONE INTERVIEW (Initial contact with school and teacher)

SCHOOL_____ TEACHER _____

A. Introduction to a secretary: Good Morning, my name is _____ from the ACVE at N.A.U. We are doing a study on the uses of computers in Voc Ed classes (occupational). Can you give me the name of the teachers in your school who use computers in their Voc Ed classes? (Agriculture, Bussiness, Distributive Ed., Trades & Industry, Technical)

B. Introduction to a teacher: Good morning/afternoon, My name is _____. I'm with the ACVE at N.A.U. and we are doing a study on the effectiveness of computers in the Voc Ed classes in High Schools and Community Colleges in Arizona. You were recommended as a major user of computers in your area and I would like to ask you a few questions if it is convient for you right now.(If not, when: Date: Time: Name: Phone number:).

1.a) What classes do you teach?

b) In which ones do you use computers?

c) How long have you been using computers in connection with teaching?

2. How are you using the computers? (BE SPECIFIC - what topical areas):

Class room management:

Interactive instruction:
- drill and practice
- tutorial

Simulation:

Demonstration:

Other:

3. In your estimation, how much do the Voc Ed students use the computers?

# of Voc Ed students:
% of Voc Ed population:
Average time / week / student:

4. How many and what types of computers do you use in your classes? What peripherals do they have (disk drives, cassette tape drives, printers, modems)?:

TYPE	#	PERIPHERALS

5. What software do you use? (Do you use prepackaged or do you write your own?)

6. Where are the computers placed? (Labs or classrooms)

C.1. Are there any other Voc Ed teachers in your school using computers for their classes?

Name: Class:
Name: Class:
Name: Class:

2. Do you know of teachers in other high schools or community colleges making extensive use of computers in their Voc Ed classes?

Teacher:	School:	Area:
Teacher:	School:	Area:
Teacher:	School:	Area:
Teacher:	School:	Area:

3. Can you give me the name of the administrator who is most familiar with your computer activity?

(Name: Phone #)

4. Who would be the most knowledgeable about the cost of the system you use?

(Name: Phone #)

CLOSE: Thank you very much for your time--you've been very helpful. I or one of my colleagues may be getting back to you in a couple of weeks to see about getting more details, if that is OK with you.

APPENDIX B

TELEPHONE INTERVIEW RESULTS

AGRICULTURE EDUCATION

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Casa Grande Everett Rhodes	1 - Apple 2 - Heathkits	70	1 hour/week	1 year	VisiCalc, PFS, Agriculture Business, Classroom Management
Central Arizona College Pat Harrington		54	4 hours/week 8 hours/week	2 years	Farm Business Management, Lotus 1-2-3, Red River Farm Package, VisiCalc, PFS Database
Chandler High School Willard Barney	10 - TRS-80	80	- 0 -	1 1/2 years	VisiCalc, PFS, Records, Agriculture Production, Grading, Ledger
Gilbert High School Joe Grianio	1 - Apple IIe	14 10	1 hour/week	1 year	Agriculture Business, Agriculture Management Kit, Animal Science (Demonstration)
Kafa High School Jim Armbruster	1 - Apple	5	2 hours/week		Agriculture Business (Demonstration), Animal Science
Westwood High School Richard Sawyer	1 - TRS-80 15 - Commodore PET	15 - 20	1 hour/week	2 years	Grading, Test, Database, Wordprocessing, VisiCalc, Inventory Management, Profile 3, Mail List
Yuma High School Ralph Bernard	1 - Apple	16	1 hour/week		Classroom Management Demonstration, Animal Science, Agriculture Business

BEST COPY AVAILABLE

BUSINESS

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Benson High School Ms. Curtis	24 - Terminal Mannesman-Talley	105	2 1/2 hours/week	3 months	Computer Awareness, Word-processing (WordStar)
Canyon Del Oro High Sch Elaine Ablekoff	16 - IBM 2 - A. B. Dick W.P.	75-100	3-5 hours/week	4 years	EasyWriter, CABDICK, Typing (Tutorial)
Central Arizona College D. J. O'Dell	6 - TRS-80 2 - Apple 14 - IBM PC 10 - DEC-10 3 - Lexitron	125 Accounting 25 Business Office 150 Dataprocessing	5 hours/week	4 years	Wordprocessing - WordStar, Spreadsheets, Database, Microcomputer Accounting
Cochise Community College Dr. James Young	20 - TRS-80 6 - Apple 10 - Horizon Commodore		5 hours/week		Programming, Superscript, Wordprocessing, VisiCalc, Dataprocessing
Coconino High School Jeanette Glenn	2 - IBM			1 year	WordStar
Eastern Arizona College Pat England	20 - Apple IIe	118		5 years	Dataprocessing
Flagstaff High School Laura Sherman	2 - IBM 10 - TRS-80 5 - Atari		3 hours/week 5 hours/week 1 hour/week	7 years	Displaywriter, Write own Programs
Globe High School Pat England	6 - TRS-80	100		5 years	Computer Literacy, Office Machines, Wordprocessing, Database, Spreadsheets
Joseph City High School Scott Cressal	13 - TRS-80	18	2-5 hours/week	1 year	Radio Shack Software, Office Practice, Dataprocessing
Mesa Central Voc. Tech. Ron Baughn	5 - Commodore 9000	8-11	2 hours/week	1 year	Programming in COBOL and BASIC
Mesa Community College Mary Alcorn	12 - DEC II 4 - DEC I 1 - Wang 2 - Xerox 860 1 - IBM Displaywriter 12 - Apple IIe	100	5 hours/week	8 years	Records Processing, Wordprocessing

BUSINESS (Continued)

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Northland Pioneer College Lois Coltrin	5 - Apple	10	3-6 hours/week	1 year	Office Education, Wordprocessing
Phoenix Area Vocational Center Al Bachrad	16 - Commodore 8032 10 - Commodore 9000 5 - TRS-80	95	6 hours/week	4 years	Radio Shack data entry practice, Southwestern Accounting Package, Wordprocessing, Data Entry, Dataprocessing, Computer Literacy, VisiCalc, WordPro, Commodore Public Domain Software
Pima County Community College Mr. Porter	10 - Apple 12 - NorthStar	100	3 hours/week		Office Education, Business Management, Computer Applications for Management, Wordprocessing
Scottsdale Community College Mr. L. L. Via	30 - Apple 9 - DecMates 1 - VAX 1 - Exxon (VYDEC)		3-5 hours/week	8 years	Wordprocessing
Scottsdale Technical Center Margaret Muller	24 - TRS-80 1 - Apple IIe	30	10 hours/week	2 years	Superscript, Radio Shack Profile Database, VisiCalc, Superscript, Southwestern (data entry)
Williams High School Carol German	18 - Apple IIe	20		4 years	General Ledger, VisiCalc, WordStar, AppleWriter, QuickFile, PFS

HEALTH

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Central Arizona Community College Edna Ross (Nursing)	9 - Apple II 1 - IBM PC 1 - Compaq	50	1/2 hour/week	1-1/2 years	Clinical Simulation, Pediatric Cardiovascular Problems, Games, Nursing Process (Medisim)
Cochise Community College Barbara Bean	8 - Apple IIe	70 Freshmen 36 Sophomores	1-2 hours/week	1 year	Writes her own on Dosages and IV Drill and Practice
Maricopa Technical Community College Cris Stein	3 - Apple II	27	5 hours/week	3 years	Clinical Simulation, Blood Gases
Pima County Community College Chris Clifford	3 - Apple II	200	1 hour/week		VisiCalc, PFS: Classroom Management, Aristotle's Apple: Drill and Practice
Scottsdale Community College Jackie Ruggles	30 - Apple IIe	48	Self-Paced		Simulations, Medical Terminology

HOME ECONOMICS

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Amphitheater High School Nancy Graham	2 - Kaypro 2- Apple IIe	86	1 hour/week	6 months	HERO, Dairy Council - Nutrition, E.A.S.E., Crossword Puzzles
Casa Grande High School Jean Beach	1 - Apple IIe	100	Minimal	1 year	Classroom Management, Apple Gradebook, VisiCalc
Chandler High School Sue Pew	8 - TRS-80 1 - Tandy 2000	32		1 year	Nutrition, HERO, Time Management, Resumes
Chaparelle High School Linda Dioguardi	2 - Apple IIe	No use yet		3 years	Business, Management, HERO, Job Seeking, Nutrition
Kofa High School Janis Shelton	1 - Apple	20	Few Minutes	1 year	Classroom Management
Tolleson High School Marilyn Keller	1 - TRS-80			2-3 years	Classroom Management Profile, Scripsit

MARKETING AND DISTRIBUTIVE EDUCATION

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Canyon Del Oro Maureen Todd	16 - IBM PC 1 - TRS-80	200	5 hours/week	2 years	Stock Market, Forecasting, Entrepreneurship
Carl Hayden High School Bev Jarvis	10-15 TRS-80	20	1 hour/week	2 months	Business Game, Advanced Marketing
Kingman High School John Pool	10 - Apple IIe	56	Minimal	1 year	Jeans Factory, Sweetshop, Wordprocessing
Sahauro High School Ed Savel	15 - Apple II	20	12 hours/sem.	8 months	Jeans Factory, Manufacturing, Retailing

TRADES & INDUSTRY

School and Teacher	Computer Number and Kind	Number of Students in Class	Hours Per Week Per Student	Teacher's Computer Experience	Software/Application
Casa Grande High School Charles Staats	3 - Heathkits	7	2-1/2 hours/week	2 years	Electronics Repair
Central Arizona College Frank Westerman	10 - Apple IIe	12	4 hours/week	1 year	MATC CAD
Cochise Community College Al Walker	5 - Apple II	25	5 hours/week	5 years	Drafting - MATC
Kofa High School Harold Krishner	1 - TRS-80	30	1 hour/week	2 years	Student-Written Electronics
Palo Verde High School Bob Mentzer	2 - Apple IIe	110	Minimal		Drafting: T-Square
Phoenix Area Vocational Center Rosco Culver	1 - TRS-80	2 Advanced 32 Beginning	10 hours/week	2 years	Electronics
Pima County Community College Marvin Mandel	1 - Apple IIe	7	10 hours/week	1 year	CAD APPLE
Round Valley High School Barry Williams	1 - Apple IIe			2 years	Classroom Management, Automotive Classes

APPENDIX C

ON-SITE INTERVIEWEES

APPENDIX C

ON-SITE INTERVIEWEES

1. Chandler High School, 350 North Arizona Avenue, Chandler, AZ 85224
   Telephone: (602) 963-4537

   Harold Dusick, Assistant Principal
   Willard Barney, Instructor, Agriculture
   Bruce Kinde, Instructor, Graphics
   Jim Myers, Instructor, Business
   Sue Pew, Instructor, Home Economics/HERO

2. Deer Valley High School, 18424 North 51st Avenue, Glendale, AZ 85308
   Telephone: (602) 866-5852

   Art Nichlas, Assistant Principal
   Peggy Ayers, Instructor, Mathematics
   Loyd Myers, Department Chairman, Industrial Education
   Tim Tankersley, Instructor, Agriculture

3. Amphitheater High School, 125 West Yavapai, Tucson, AZ 85705
   Telephone: (602) 293-0300

   Dr. Robert Carlson, Assistant Principal
   Nancy Graham, Instructor, Home Economics
   Mary Reinecke, Instructor, Business

4. Palo Verde High School, 1302 South Avenida Avenue, Tucson, AZ 85710
   Telephone: (602) 745-4700

   William Ismay, Principal
   Bob Mentzer, Instructor, Drafting

5. Sahuaro High School, 545 North Camino Seco, Tucson, AZ 85710
   Telephone: (602) 721-6320

   Leo Johnson, Principal
   Barbara Herzog, Department Chairperson, Business
   Joan Tolle, Instructor, Business

6. Central Arizona College, Woodruff at Overfield Road, Coolidge, AZ 85228
   Telephone: (602) 723-4141

   Bob Putz, Coordinator of Computer Services
   Gary Mickolajak, Occupational Dean
   Pat Harrington, Professor, Farm Business Management
   D. J. O'Dell, Department Chairman, Nursing
   Edna Ross, Director, Nursing
   Frank Westerman, Professor, Drafting

7. Phoenix, College, 1202 West Thomas Road, Phoenix, AZ 85013
Telephone: (602) 264-2492

Harry Vesley, Associate Dean
Jim Black, TICCIT Program
Bette Simmons, Department Chairperson, Records Management & Wordprocessing
Leroy Stevens, Instructor, Electronics
Pete Zawasky, Instructor, Electronics

8. Pima County Community College, 2202 West Anklam Road, Tucson, AZ 85709
Telephone: (602) 884-6666

Kenneth McCollester, Associate Dean, Engineering Sciences (West Campus)
Carol Pearse, Alternative Learning Center (Downtown Campus)
Tim Murphy, Educational Development (Downtown Campus)
Chris Clifford, Instructor, Nursing (Downtown Campus)
Dan Davidson, Director, Microcomputer Center
John Jarchow, Department Chairman, Drafting (West Campus)
Marvin Mandel, Instructor, Drafting (Downtown Campus)